

# Oral Poliomyelitis Vaccination Program in Berks County, Pennsylvania

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**R**EGISTRATION CARDS are frequently used in conducting mass poliomyelitis vaccination programs to obtain a community-wide immunization level. Analysis of the cards to determine the types of vaccine received by each individual and differences within the community by geographic location, age, sex, and race has rarely been accomplished (1). We believe this paper provides an analysis in more detail than has been given in previous reports of vaccination programs in the United States.

## Development of Program

The Berks County Medical Society, jointly with the medical societies of Lehigh and Northampton Counties, began preparing for a Sabin vaccination program in the spring of 1962. Pfizer vaccine was selected and type I scheduled for October 3, 1962. Postponement was decided because of the occurrence of cases suspected of being related to vaccination with Sabin type III, the report issued by the Surgeon General about the cases (2), and the attendant publicity. Berks County rescheduled for January, April, and June 1963, for types I, III, and II respectively; Lehigh and Northampton

rescheduled for March, May, and November 1963.

Publicity for the program included newspaper articles and advertisements, radio interviews (including one with Dr. A. B. Sabin), radio and television spot announcements, and talks to civic groups by physicians and civic leaders.

## Operation of Program

School children were vaccinated during regular sessions in all public and parochial schools by the school nurse, under supervision of the school physician. A consent form signed by the parent was required on the registration card of each child under 18. The nurse or teacher retained this card on which receipt of types III and II was also entered.

Preschool children and adults were invited to 1 of the 34 Sunday clinics held throughout the county, mostly in school buildings. Clinics for special groups were held in general hospitals, a mental hospital, many industrial plants, and offices of private physicians. Many children who had been absent from school, mainly because of illness, during their school vaccination programs attended the Sunday clinics. Makeup clinics were held on the Sunday following the regular clinics in one location, the headquarters of the medical society.

On the participant's first visit to the clinic, the following information was entered on his registration form: name, address (street, city, township, or borough), physician's name and address, participant's age and sex, number of

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doses of Salk vaccine previously received, date of Sabin type I vaccination, and clinic location number.

### Registration and Records

The Pennsylvania Department of Health designed the registration cards. Instructions for registration were given at a meeting of clinic coordinators and volunteers; mimeographed instructions were distributed to each clinic. In the schools, participants were registered by nurses, teachers, and volunteers; in regular clinics, by several hundred volunteers; and in industrial installations, hospitals, and physicians' offices, by designated employees.

The initial registration for type I was entered on a white card. Many thousands of persons, however, arrived at clinics with the registration form clipped from the newspaper. Volunteers later transferred the information from the form to a card. During the clinic, each person received an appointment slip giving the clinic number and the date for type III vaccination.

Most persons arrived for type III with their completed appointment slip; if not, another was made out. Each person starting with type III had a yellow registration card filled out, and each one starting with type II had a pink one completed. When anyone arrived with a newspaper replica, this was held and later copied.

The Pennsylvania Department of Health, and later the Berks County Medical Society, employed three clerks full time in preparing the cards for IBM processing. The clerks coded each card by vaccinee's residence in one of the four sections of Reading, in one of 74 other communities, or outside the county. Where there was doubt the clerks often called the participant or searched local directories and telephone books. All cards were then completely alphabetized.

After type III was given, the vaccinee's slip was matched with the original registration. Date and type III were entered on the card. New cards for persons starting with type III were coded and alphabetized. After the type II clinic, appointment slips were matched against registration cards, and entries for date and type were made on the cards. New cards

for persons starting with type II were then coded.

In schools the nurse or teacher retained the original registration card; no appointment slips were given. When the child received type III or type II, the date and type were entered on the white card. If the child started with type III or type II, as in the Sunday clinics, a yellow or pink card was made out. On completion of school immunizations, school nurses sent all their cards on the children to the clerical office of the Sabin program where they were coded and alphabetized.

### Problems

In several clinics a number of adults were vaccinated without registration when the lines were long and the clinics crowded. Many residents of suburban and rural areas had difficulty in identifying the borough or township in which they lived. Post office addresses (Rural Free Delivery route numbers and the like) did not coincide with census tract areas. Coding for residence was not as difficult, however, as expected except when respondent or registrar gave an unidentifiable or incorrect address.

The major difficulty in processing cards was the time required to copy newspaper forms and to alphabetize cards and appointment slips so that they could be matched. Matching was essential to determine whether the individual had obtained one, two, or three types and which types or combinations of types. The volume of records (600,000), the illegibility of some of them, and the failure of many participants to go to the same clinic for all three types made tabulation difficult.

About 5 percent of the participants received the first type in one clinic location and the second and third types in other clinics. Their cards could be located only after 95 percent of the records had been matched for each clinic and the remaining 5 percent combined into one alphabetical file.

Likewise, about 5 percent of the school children had received one or two types in the school program and the other two or one in the Sunday clinics. Records on these were located and matched after the third was given.

Collection of field data took approximately

10,000 man-hours: 3,300 for 3 full-time persons working 6 months and 6,700 for 30 volunteers working intermittently over the same period. Alphabetizing took about 5,500 hours; copying from newspaper forms, 2,400; matching the forms and making entries, 1,400; coding, particularly for residence, 500; and miscellaneous duties, 200. The workers were paid \$2,750 by the Pennsylvania Department of Health and \$2,750 by the Berks County Medical Society. The cards were subsequently sent to Harrisburg, where approximately 500 man-hours were spent in preparing punched cards and processing them on IBM machines, at an estimated cost of \$3,760.

The original cards were returned to the medical society office, where clerks and volunteers sorted them again. Each physician in the county received an alphabetized file of his patients.

## Results

A total of 171,256 persons, including non-county residents, received 1, 2, or 3 types of Sabin vaccine at the various clinics. Type I was given first to 155,543; type III was given next to 160,703 and type II given last to 154,185. (An additional 3,338 persons received 1 or more types in a series of 3 makeup clinics held in November and December 1963 and in January 1964 at the headquarters of the county medical society.)

Participation was greatest for type III, because a larger number started with the second clinic (type III) than dropped out after the first clinic (type I). Separate IBM runs to determine these exact numbers were not done.

From the county population of 275,414 persons, 165,660 residents, or 60.2 percent, participated. Of the 165,660 residents, 3.4 percent received 1 type, 8.1 percent 2 types, and 48.7 percent the complete series of 3 types (table 1). Persons obtaining only one type received type I if they attended the first clinic, type III if they attended the second, and type II if they attended the third. Recipients of two types received either types I and III, I and II, or III and II. Those obtaining all three types of course received types I, III, and II, in that order. Among participants, 81 percent ob-

tained the complete series of three types. The latest available U.S. census figures were used for the population base.

**Age.** The proportion of the population receiving all three types averaged 48.7 percent for all ages, 40.0 percent in children under 1 year, 87.0 percent (the high) in children 6-9 years, and 12.3 percent (the low) in persons over 64 years (table 2 and chart).

Among participants in the program, the age group with the lowest percentage to complete the series was infants under 1 year; the highest percentage was found in school children 10-14 years.

Our advance publicity was not designed to promote attendance of infants under 6 weeks, and they were not brought to the clinics. Therefore we excluded them from the population base for computation of immunization achieved by age groups. We found, moreover, that a small number of physicians advised parents not to bring infants of less than 6 months to the clinics. It was also, of course, harder for the parent to bring an infant or preschool child to a Sunday clinic than to have a child vaccinated while in attendance at school.

Sabin stated in a taped telephone interview over radio station WEEU, Reading, Pa., on March 28, 1963, that "community protection can be achieved by vaccination of 80 percent of preschool and school children in any community." This figure was used as an arbitrary goal.

Since only 76 percent of the Berks County children 0-17 years received all three Sabin types, the desired result was not achieved for the county as a whole. Nor was it accomplished in any quadrant of Reading. The desired result

**Table 1. Degree of protection by Sabin vaccine, Berks County, Reading, and balance of the county, 1963**

Locality	Percent of population receiving—			
	One type	Two types	Three types	One, two, or three types
Berks County-----	3.4	8.1	48.7	60.2
Reading (city)-----	4.0	8.7	42.1	54.8
Balance of county-----	3.1	7.7	52.3	63.1

was effected, however, in 17 of the 37 census tract areas in Berks County. Of school children 6-17 years, more than 80 percent completed the series in 3 quadrants of Reading and in 32 tract areas of the county. For infants under 1 year, no area achieved a completion rate higher than 63 percent. For preschool children, the goal of 80 percent with a complete series was achieved in 6 of 37 tracts.

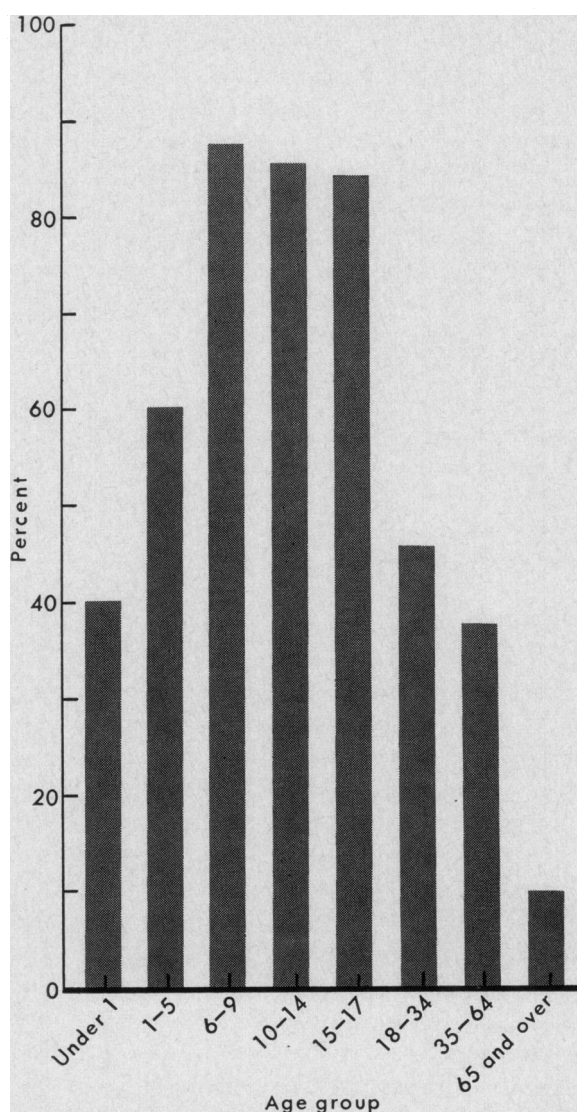
**Residence.** Of the 5,596 participants in the clinics who were nonresidents of Berks County, some were from adjacent counties and the remainder from as far away as South Africa.

The percentage obtaining the complete series varied in each census tract, ranging from 70 to 88 percent, with the low in southwest Reading and the high in Hamburg.

Only 42.1 percent of city residents obtained the protection of the complete series, as against 52.3 percent for the balance of the county. The lowest completion rate in Reading was in the southwest portion, the lowest socioeconomic area. In the county, the three lowest areas were the Colebrookdale, Amity, and Union Townships. These communities are on the Lehigh County line, and many persons in them went to clinics in Lehigh.

**Race.** Berks County has a very small non-white population, 1.8 percent compared with

**Residents protected by complete series of Sabin vaccine, by age group, Berks County, 1963**



**Table 2. Protection with Sabin or Salk vaccine of participants in Sabin program by age group, Berks County, 1963**

Age groups (years)	Three types of Sabin vaccine		Three or more doses of Salk vaccine	
	Number	Percent of age group	Number	Percent of age group
All ages.....	134, 008	48. 7	81, 427	29. 6
Under 1.....	1, 778	40. 0	612	12. 1
1-5.....	15, 563	61. 1	13, 929	54. 7
6-9.....	16, 513	87. 0	14, 166	74. 6
10-14.....	19, 554	85. 6	16, 859	73. 8
15-17.....	9, 768	84. 9	8, 764	76. 2
18-34.....	25, 574	46. 2	17, 212	31. 1
35-64.....	39, 779	37. 8	8, 140	7. 7
Over 64.....	3, 791	12. 3	814	2. 6
Unknown.....	1, 688	-----	916	-----

**NOTE:** No information available on Salk vaccine previously received by persons who did not come to the Sabin clinics.

7.6 percent for the State average. Of the total 4,832 nonwhites, 4,228 live in Reading, 1,842 in the southwest quadrant.

Considering the city only, fewer registrations showed race of participant than other characteristics; 1,795 registration cards lacked this indication. Observations at the clinics indicated that many nonwhites did not complete the item on race on the form they brought with them, and some volunteers were reluctant to inquire or fill in the item. The unknowns as to race were redistributed in accordance with the distribution of those who came to the clinic

and stated their race, a distribution close to the race distribution of the city population—4.3 percent nonwhite.

Fifty-five percent of Reading's white residents participated and 43 percent completed the series, whereas 59 percent of the nonwhite residents participated and 40 percent completed the series (table 3).

*Sex.* Males and females participated in accordance with their distribution in the population.

*Salk protection.* Of the Sabin program participants, 29.6 percent had previously received 3 or more Salk injections, with percentages ranging from 2.6 percent in persons 64 years and older to 76.2 percent of children 15–17 years (table 2). The percentage was lower in Reading (24.7 percent) than in the balance of the county (32.3 percent).

The 20,387 persons who came to the clinics but did not state their Salk experience were redistributed according to the experience reported by the remaining 145,273 participants. It was assumed that the Salk experience of those who did not come to the clinic was half as good as those who came, that is, if two out of three clinic participants reported receiving three or more Salk injections, then only one out of three nonparticipants was credited with the same protection.

*Salk and Sabin protection.* On the basis indicated, 65.3 percent of Berks County residents had received a complete series of Salk or Sabin vaccine or both. A survey conducted in June 1964 by H. B. Bock and Hayman (unpublished) on a sample of 806 households produced the confirmatory figure of 63.7 percent. In that

survey and the study reported here, combined protection by both vaccines was lowest in the age groups over 64 years and under 1 year and highest for school-age children.

## Comments

This poliomyelitis vaccination campaign was not as successful as many others which have been reported in the United States (3, 4), even allowing for under-registration.

The most successful programs have been conducted in Communist countries where population groups selected for vaccination were all actually vaccinated. Thus, in Hungary, 100 percent of the children 8 months to 16 years had been given 1, 2, or 3 series of monovalent or trivalent vaccine (5).

Factors which may have caused poor response in Berks County include the postponement of the program and the attendant publicity about cases allegedly related to vaccination, the lack of interest or apathy of many adults despite intensive publicity and public education and, on the part of a few physicians, less than wholehearted participation.

Sabin's concept of herd immunization is based on the theory that the virus spreads from the intestinal tract of vaccinated susceptibles to unvaccinated susceptibles throughout the community (6). Regarding seroimmunity, Lepow and associates recently found that "among children who had not received inactivated vaccine or a specific type of oral vaccine, a titer of 1:8 or greater for a specific type was found only in instances where other family members had received the specific type" (4). If virus spread occurs only within families, community protection becomes harder to achieve.

The experience in Berks County that school children were the best immunized duplicates that of most other communities. The same is true for protection against smallpox, diphtheria, and tetanus and the experience with other health measures, such as those to improve hearing, vision, and dental status. School children get relatively more health service than any other group in the community.

Our study showed there was an immediate need in Berks County for initial vaccination of many infants and preschool children. As Sabin

**Table 3. Sabin clinic experience by race in Reading and its sections, 1963**

Area	Percentage participating		Percentage completing series	
	White	Non-white	White	Non-white
Reading (city)...	54.7	58.8	43.2	40.1
Northeast.....	57.3	75.0	45.7	46.2
Southeast.....	51.6	58.3	40.1	38.1
Southwest.....	49.1	45.0	38.4	31.6
Northwest.....	58.3	75.5	46.0	52.2

has pointed out repeatedly, even where programs have been completely successful, the necessity remains for a continuing program of "immunization of oncoming generations of children during their first year of life" (7, 8).

### Summary

Detailed tabulation and analysis of all registrations were accomplished for the oral poliomyelitis vaccination program conducted by the medical society of Berks County, Pa., in 1963.

Including nonresidents, 171,256 persons received at least one type of vaccine. Sixty percent of the county's residents participated, 3 percent receiving 1 type, 8 percent 2 types, and 49 percent all 3 types. The proportion receiving all 3 ranged from 12 percent of persons over 65 years to 86 percent of school children. Protection by the three types was lower in Reading than in the rest of the county, and in that city, the lowest rates prevailed in the lowest socioeconomic area and among nonwhites.

Sixty-five percent of the residents of Berks County are estimated to be well protected by Salk, Sabin, or both. The Sabin program, however, needs to be repeated for infants throughout the county and for preschool children in many areas, especially in southwest

Reading. Moreover, in all communities, even where programs have been completely successful, continuing immunization of oncoming generations of children during their first year of life is necessary.

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## Electron Microscope

Cornell University is the recipient of a grant to develop an electron microscope with a resolution of 2 angstroms which could focus on particles eight-billionths of an inch in size. The best existing commercial electron microscopes have a resolution of only 4 to 6 angstroms.

The grant of \$155,900 for the first year of a 4-year project will be administered and financed jointly by the National Institute of General Medical Sciences, Public Health Service, and the National Science Foundation. When the instrument is perfected, it should make possible direct observation of atoms within enzymes, proteins, viruses, and other molecules of biological importance. Scientists could identify the sequence of components of the DNA molecule, which is the basis of life and heredity.